

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: X. Long Dai et al.  
Serial No.: 10/661,187  
Date Filed: September 12, 2003  
Group Art Unit: 2624  
Confirmation No.: 8281  
Examiner: Patel, Jayesh A.  
Title: **SYSTEM AND METHOD FOR ACQUIRING AND  
PROCESSING COMPLEX IMAGES**

**MAIL STOP – AMENDMENT**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

**RESPONSE TO OFFICE ACTION**

In response to the Office Action mailed May 11, 2007, Applicants respectfully submit the following amendments set forth below and request favorable action thereon.

**Amendments to Claims** are reflected in the listing of claims which begins on page 2 of this paper.

**Remarks/Arguments** begin on page 12 of this paper.

## CLAIM AMENDMENTS

### IN THE CLAIMS

This listing of the claims will replace all prior versions, and listing, of claims in the application or previous response to office action:

1. (Withdrawn) A method for registering corresponding intensity images comprising:
  - providing a first intensity image;
  - providing a second corresponding intensity image;
  - separately performing an edge enhancement operation on the first intensity image and the second intensity image;
  - separately performing a noise removal thresholding operation on the first intensity image and the second intensity image;
  - separately transforming the first intensity image and the second intensity image using a Fourier transform;
  - computing a coherence function using first intensity image and the second intensity image;
  - transforming the coherence function using an inverse Fourier transform;
  - performing a magnitude operation on the transformed coherence function;
  - calculating a confidence value based on the magnitude operation; and
  - determining the acceptability of the correspondence between the first intensity image and the registration using the computed confidence value.
2. (Withdrawn) The method of Claim 1 further comprising providing the first intensity image and the second intensity image using a digital holographic imaging system.
3. (Withdrawn) The method of Claim 1 wherein calculating the confidence value utilizes at least one identified coherent peak.

4. (Withdrawn) The method of Claim 1 wherein calculating the confidence value further comprises determining the difference in strength between a first coherent peak and a second peak.

5. (Withdrawn) A method for registering holographic images comprising:  
providing a first holographic image and a second corresponding holographic image;  
separately transforming the first holographic image and the second holographic image using a Fourier transform;  
separately performing a sideband extraction operation on the resulting first holographic image and the second holographic image;  
separately filtering the resulting the first holographic image and the second holographic image using a bandpass filter;  
separately transforming the resulting first holographic image and the second holographic image using an inverse Fourier transform;  
separately performing a magnitude operation on the resulting first holographic image and the second holographic image;  
separately performing a noise removal thresholding on the resulting first holographic image and the second holographic image;  
separately transforming the resulting first holographic image and the second holographic image using a Fourier transform;  
calculating a coherence function of the resulting first holographic image and the second holographic image;  
transforming the coherence function using an inverse Fourier transform;  
performing a magnitude operation on the resulting transformed coherence function;  
calculating a confidence value based on the magnitude operation; and  
determining the acceptability of the correspondence between the first holographic image and the second holographic image based upon the confidence value.

6. (Withdrawn) The method of Claim 5 further comprising providing the first holographic image and the second holographic image using a digital holographic imaging system.

7. (Withdrawn) The method of Claim 5 wherein calculating the confidence value utilizes at least one identified coherent peak.

8. (Withdrawn) The method of Claim 5 wherein calculating the confidence value further comprises determining the difference in strength between a first coherent peak and a second peak.

9. (Withdrawn) A method for registering holographic images comprising:  
providing a first holographic image and a second corresponding holographic image;  
separately transforming the first holographic image and the second holographic image using a Fourier transform;

separately performing a sideband extraction operation on the resulting first holographic image and the second holographic image;

separately filtering the resulting the first holographic image and the second holographic image using a low pass filter;

separately transforming the resulting first holographic image and the second holographic image using an inverse Fourier transform;

separately performing a phase operation on the resulting first holographic image and the second holographic image;

separately performing a phase-aware edge enhancement operation on the resulting first holographic image and the second holographic image;

separately performing a noise removal thresholding on the resulting first holographic image and the second holographic image;

separately transforming the resulting first holographic image and the second holographic image using a Fourier transform;

calculating a coherence function of the resulting first holographic image and the second holographic image;

transforming the coherence function using an inverse Fourier transform;  
performing a magnitude operation on the resulting transformed coherence function;  
calculating a confidence value based on the magnitude operation; and  
determining the acceptability of the correspondence between the first holographic image and the second holographic image based upon the confidence value.

10. (Withdrawn) The method of Claim 9 further comprising providing the first holographic image and the second holographic image using a digital holographic imaging system.

11. (Withdrawn) The method of Claim 9 wherein calculating the confidence value utilizes at least one identified coherent peak.

12. (Withdrawn) The method of Claim 9 wherein calculating the confidence value further comprises determining the difference in strength between a first coherent peak and a second peak.

13. (Original) A method for registering holographic images comprising:  
providing a first holographic image and a second corresponding holographic image;  
separately transforming the first holographic image and the second holographic image using a Fourier transform;  
separately performing a sideband extraction operation on the resulting first holographic image and the second holographic image;  
separately filtering the resulting the first holographic image and the second holographic image using a bandpass filter;  
calculating a coherence function of the resulting first holographic image and the second holographic image;  
transforming the coherence function using an inverse Fourier transform;  
performing a magnitude operation on the resulting transformed coherence function;  
calculating a confidence value based on the magnitude operation; and

determining the acceptability of the correspondence between the first holographic image and the second holographic image based upon the confidence value.

14. (Original) The method of Claim 13 further comprising providing the first holographic image and the second holographic image using a digital holographic imaging system.

15. (Original) The method of Claim 13 wherein calculating the confidence value utilizes at least one identified coherent peak.

16. (Original) The method of Claim 13 wherein calculating the confidence value further comprises determining the difference in strength between a first coherent peak and a second peak.

17. (Original) A method for registering holographic images comprising:  
providing a first holographic image and a second corresponding holographic image;  
separately transforming the first holographic image and the second holographic image using a Fourier transform;  
separately performing a sideband extraction operation on the resulting first holographic image and the second holographic image;  
separately filtering the resulting the first holographic image and the second holographic image using a bandpass filter;  
calculating the conjugate product of the resulting first holographic image and the second holographic image;  
transforming the conjugate product using an inverse Fourier transform;  
performing a magnitude operation on the resulting transformed conjugate product;  
calculating a confidence value based on the magnitude operation; and  
determining the acceptability of the correspondence between the first holographic image and the second holographic image based upon the confidence value.

18. (Original) The method of Claim 17 further comprising providing the first holographic image and the second holographic image using a digital holographic imaging system.

19. (Original) The method of Claim 17 wherein calculating the confidence value utilizes at least one identified coherent peak.

20. (Original) The method of Claim 17 wherein calculating the confidence value further comprises determining the difference in strength between a first coherent peak and a second peak.

21. (Withdrawn) A method for registering holographic images comprising:  
providing a first holographic image and a second corresponding holographic image;  
separately transforming the first holographic image and the second holographic image using a Fourier transform;  
separately performing a sideband extraction operation on the resulting first holographic image and the second holographic image;  
separately filtering the resulting the first holographic image and the second holographic image using a bandpass filter;  
calculating the conjugate product of the resulting first holographic image and the second holographic image;  
transforming the conjugate product using an inverse Fourier transform;  
performing a magnitude operation on the resulting transformed conjugate product;  
and  
performing an integer translation and subpixel modeling operation on the resulting magnitude image.

22. (Withdrawn) The method of Claim 21 further comprising providing the first holographic image and the second holographic image using a digital holographic imaging system.

23. (Withdrawn) A method for registering a test holographic image and a reference holographic image in a digital holographic imaging system comprising:

- providing a test sideband from the test image and a reference sideband from the reference image;
- separately filtering the test sideband and the reference sideband using a bandpass filter;
- calculating the conjugate product of the resulting test sideband and reference sideband;
- transforming the conjugate product using an inverse Fourier transform;
- performing a magnitude operation on the resulting transformed conjugate product;

and

- performing an integer translation and subpixel modeling operation on the resulting magnitude image.

24. (Withdrawn) The method of Claim 23 further comprising providing the test holographic image and the reference holographic image using a digital holographic imaging system.

25. (Withdrawn) A method for comparing corresponding holographic images comprising:

- obtaining a first holographic image;
- obtaining a second holographic image corresponding to the first holographic image;
- comparing the first holographic image and the second holographic image and obtaining a first difference image description;
- obtaining a third holographic image corresponding to the second holographic image;
- comparing the second holographic image and the third holographic image and obtaining a second difference image description; and
- comparing the first difference image and the second difference image description.



26. (Withdrawn) The method of Claim 25 further comprising comparing the first holographic image, the second holographic image and the third holographic image in the frequency domain.

27. (Withdrawn) The method of Claim 25 further comprising comparing the first holographic image, the second holographic image and the third holographic image in the spatial domain.

28. (Withdrawn) A method for generating a difference between a first complex image and a second corresponding complex image comprising:

converting the first complex image and the second complex image to an amplitude representation; and

computing the magnitude of the difference between the resulting amplitude representations.

29. (Withdrawn) A method for generating a phase difference between a first complex images and a corresponding second complex image comprising:

converting the first complex image and the second complex image to a first phase image and a second phase image; and

computing the effective phase difference between the first phase image and the second phase image.

30. (Withdrawn) A method for generating a difference between first complex image and a second corresponding complex image comprising:

subtracting the first complex image and the second complex image in the complex domain; and

computing the amplitude of the resulting complex difference.

31. (Withdrawn) A method for determining common differences between difference images in a digital holographic imaging system comprising:

thresholding a first difference image and a second difference image; and  
shifting one of the thresholded images by a selected amount such that the common differences of the both difference images are represented by a logical AND of the shifted thresholded image and the unshifted thresholded difference image.

32. (Withdrawn) A method for determining common differences between difference images in a digital holographic imaging system comprising:  
shifting one of the difference images by a selected amount;  
thresholding the shifted difference image; and  
computing the common differences by performing a logical-AND of the shifted unthresholded image and the shifted thresholded image.

33. (Withdrawn) A method for determining common differences between two corresponding difference images in a digital holographic imaging system comprising:  
shifting the first difference image by a selected amount;  
combining the shifted image with the second image; and  
thresholding the combined image.

34. (Original) The method of Claim 13, further comprising:  
separately transforming the resulting first holographic image and the second holographic image using an inverse Fourier transform;  
separately performing a magnitude operation on the resulting first holographic image and the second holographic image;  
separately performing a noise removal thresholding on the resulting first holographic image and the second holographic image; and  
separately transforming the resulting first holographic image and the second holographic image using a Fourier transform.

35. (Original) The method of Claim 13, further comprising performing an integer translation and subpixel modeling operation on the resulting magnitude image.

36. (Original) The method of Claim 17, further comprising:  
separately transforming the resulting first holographic image and the second  
holographic image using an inverse Fourier transform;  
separately performing a magnitude operation on the resulting first holographic image  
and the second holographic image;  
separately performing a noise removal thresholding on the resulting first holographic  
image and the second holographic image; and  
separately transforming the resulting first holographic image and the second  
holographic image using a Fourier transform.

37. **(Currently Amended)** The method of Claim ~~[[13]]~~ 17, further comprising  
performing an integer translation and subpixel modeling operation on the resulting magnitude  
image.

### **REMARKS**

Applicants have carefully reviewed this Application in light of the Office Action mailed May 11, 2007. Claims 1-37 are pending in this Application. Claims 1-12 and 21-33 were previously withdrawn due to an election/restriction requirement. Claims 13-20 and 34-37 stand rejected under 35 U.S.C. § 103(a). Claim 37 has been amended to correct a typographical error. Applicants respectfully request reconsideration and favorable action in this case.

#### **Status of Claims**

The Office Action states, "Claims 1-12 and 21-33 have been cancelled and will not be considered for further prosecution." (Office Action, Page 2). However, Claims 1-12 and 21-33 were marked with the status identifier of "Withdrawn" in the Response to Election Restriction Requirement filed April 19, 2007, in accordance with M.P.E.P. § 714 (II)(C)(A), which provides that Applicants may mark non-elected claims with the status identifier of "Withdrawn." Additionally, 37 CFR § 1.142(b) provides for claims to be withdrawn "subject however to reinstatement in the event the requirement for restriction is withdrawn or overruled." Accordingly, Applicants respectfully request that the Examiner mark Claims 1-12 and 21-33 as "Withdrawn" as so marked in the earlier and current responses.

The Examiner also states that "[t]he newly added Claim 37 should be cancelled because it is a duplicate of Claim 35". (Office Action, Page 2). Applicants have amended Claim 37 so that it is no longer a duplicate of Claim 35. Accordingly, Applicants respectfully request reconsideration and full allowance of Claim 37.

#### **Rejections under 35 U.S.C. § 103**

Claims 13-20, 34, and 36 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,537,669 issued to David M. Evans et al. ("*Evans*") in view of U.S. Patent No. 4,725,142 issued to Mark Sharnoff ("*Sharnoff*").

Claims 35 and 37 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Evans* in view of *Sharnoff* and in further view of U.S. Patent No. 6,628,845 issued to Harold S. Stone et al. ("*Stone*").

*Evans* discloses a hybrid technique for finding defects on digitized device images using a combination of spatial domain and frequency domain techniques. (Col. 2, lines 57-60). The two dimensional spectra of two images are found using Fourier-like transforms. (Col. 2, lines 60-61). Any strong harmonics in the spectra are removed, using the same spectral filter on both spectra. (Col. 2, lines 61-63). The images are then aligned, transformed back to the spatial domain, then subtracted. (Col. 2, lines 63-64).

*Sharnoff* discloses a technique for the study of strains imposed by stress utilizing differential holography. (Col. 1, lines 26-37).

Claim 13 and 17 each recite a method for registering holographic images including "calculating a confidence value based on [a] magnitude operation."

Applicants respectfully submit that there is no motivation, teaching, or suggestion in the cited art to combine references. In addition, even assuming *arguendo* that the combination of *Evans* and *Sharnoff* is proper (which Applicants do not concede), Applicants submit that the combination of *Evans* and *Sharnoff* fails to teach, disclose or suggest all of the elements of the claimed embodiment of the invention. Specifically, *Evans* and *Sharnoff*, alone or in combination, fail to teach, disclose or suggest a method for registering holographic images including "calculating a confidence value based on [a] magnitude operation," as recited by Claims 13 and 17.

In rejecting Claims 13 and 17, the Examiner alleges that elements 14 and 14' and Col. 21, lines 48-53 of *Evans* discloses a method for registering holographic images including "calculating a confidence value based on [a] magnitude operation." (Office Action, Pages 3 and 5). However, the portion of *Evans* cited by the Examiner merely discloses that:

[A combined image] provide[s] the defects which are presumed to be the differences between FOV1 and FOV2. From that point the resulting defect list from **FIG. 9b** is combined with those from blocks **14** and **14'** of **FIG. 1**, and as discussed above, to generate the complete defect list for the two images.

(Col. 21, lines 48-53) (emphasis in original).

Thus, the cited portion *Evans* merely teaches generating defect lists for two images. However, the cited portion of *Evans*, in addition to the remainder of *Evans*, fails to disclose the calculation of a confidence value, much less a confidence value calculated based on a magnitude operation. Therefore, *Evans* fails to teach or suggest “calculating a confidence value based on [a] magnitude operation,” as recited in Claims 13 and 17. For at least these reasons, Applicants respectfully submit that Claims 13 and 17 are not rendered obvious by the combination of *Evans* and *Sharnoff*.

Given that Claims 14-16 and 34-35 depend from Claim 13 and Claims 18-20 and 36-37 depend from Claim 17, Applicant submits that Claims 14-16, 18-20 and 34-37 are also allowable. As such, Applicant respectfully requests reconsideration and withdrawal of the rejections under 35 U.S.C. § 103(a) and full allowance of Claims 13-20 and 34-37, as amended.

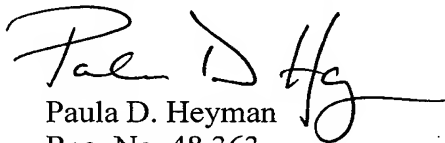
**CONCLUSION**

Applicants appreciate the Examiner's careful review of the application. Applicants have now made an earnest effort to place this case in condition for examination and allowance. For the foregoing reasons, Applicants respectfully request reconsideration of the rejections and full allowance of Claims 13-20 and 34-37, as amended.

Applicants believe there are no fees due at this time, however, the Commissioner is hereby authorized to charge any fees necessary or credit any overpayment to Deposit Account No. 50-2148 of Baker Botts L.L.P.

If there are any matters concerning this Application that may be cleared up in a telephone conversation, please contact Applicants' attorney at 512.322.2581.

Respectfully submitted,  
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Date: August 13, 2007

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